reached a velocity of 58 miles an hour from the northwest at 10:05 p. m. of the 30th. The night of the 30th the storm was one of the severest on record along the North Carolina coast near Wilmington, and an enormous amount of damage was caused by exceptionally heavy seas and high tides. The total loss of property in that section was placed at a quarter of a million dollars. A number of coasting vessels were lost, and the steamer *Catherine Whiting* was wrecked on Goss Beach, Brunswick County. The value of sailing vessels and their cargoes, which were lost along the North Carolina coast, was placed at $144,000. The ravages of the storm along the Virginia coast the night of the 30th, and during the 31st represented losses of thousands of dollars. The tide was the highest noted in years, and the high wind caused the water to overflow lowlands. At Cape Henry the wind reached a velocity of 60 miles an hour from the northeast at 6:55 p. m. of the 30th. On the New Jersey coast thousands of dollars worth of fishing property was saved by fishermen who profited by the Weather Bureau warnings, and nets to the value of thousands of dollars were lost by fishermen who did not heed the warnings. Severe gales were reported at the more exposed points along the south New England coast, but as shipping had been warned more than twenty-four hours before the storm arrived no damage was caused.

The break in the period of unseasonable high temperature over the interior of the country was accurately covered by forecasts from the 24th to the 27th.

Warnings of the beginning and ending of the first autumnal rains in California were of great value to raisin growers, fruit driers, and shipping interests.

Ample warnings were sent of the first heavy frosts of the season to the various sections which were visited by heavy frost.

On the 14th and 15th an exceptionally severe snowstorm for the season visited the foothills of the main range of the Rocky Mountains in northern Montana, causing the death of a number of men and the loss of several thousand sheep.

CHICAGO FORECAST DISTRICT.

The Lake region was remarkably free from dangerous storms during October, no storm being sufficiently severe to require the general display of signals at all upper lake ports.

The break in the heated period and the general showers which occurred from the 24th to the 27th were almost accurately forecast.—*H. J. Cox, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

No wind signals were ordered, and there were no dangerous winds.

Frost warnings were issued and verified. No damage was caused by frost, except to grapes in exposed places.—*B. S. Pague, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

On the 10th a storm which was noticed first on the Mexican frontier (one of the Sonora type) was central over the San Joaquin and Sacramento valleys. A fall in pressure along the north coast occurring at the same time the forecaster felt certain in forecasting showers for northern California. No rain had fallen for some months, except a trace, and the forecast was merely a statement of the approach of the winter season. It was so regarded by the community. On the 11th forecasts of showers were continued and were sent for Nevada, Utah, and the mountains of Arizona. It was also stated that the snow in the mountains would probably be heavy. All of these forecasts were verified. Ample warnings were given to rasin growers, fruit driers, and the shipping interests. Rain was again forecast for the district named on the 12th, and on the 13th forecasts of clearing weather by Saturday were made, which were also verified. Extensive forest fires were raging at many places in California, and a forecast of the rain which came the night of the 10th and extinguished them was of special interest to those engaged in fighting the fires.

The following, from an editorial in the San Francisco Chronicle of November 14, 1899, is one of many similar comments made by the California press regarding the rain warnings:

> Nowhere are weather predictions more uncertain than in California, although every device known to meteorologists has been enlisted to wrest the secrets of the atmosphere from it, but the weather observer is always handicapped here because information regarding the atmospheric conditions far out at sea is inaccessible at the critical time. Still, with all its imperfections and drawbacks, meteorology has occasionally been very serviceable here. The foreknowledge acquired through it of the approach of the October rainstorm and the timely warning given to agriculturists enabled them to save much property from damage and destruction. In a large section of the State over which these early storms swept there was nothing to indicate their coming at the time the warning was given. Faith in the meteorological forecast of the storm saved one Hanford, Kings County, vineyardist 56,800 trays of rasins, worth about $2 per tray, or a total money value of $113,600. It is thus science demonstrates that it has a money value when applied to industry. If other farmers and rasin growers in the interior of the State had placed similar faith in the deductions of the professional meteorologist they would not now be mourning the loss of their unprotected crops. The mariner respects the storm flag in whatever port he may be when that signal of danger to his floating craft is raised, and he makes everything snug to meet the coming blow, of which it gives him timely warning. Thus meteorology has become an invaluable aid to maritime interests.

A. G. McAdie, Forecast Official.

HAVANA FORECAST DISTRICT.

From the 22d to the morning of the 30th unusually stormy weather prevailed over Cuba, Jamaica, and the western Caribbean Sea. The only serious damage done by the storm was the sinking of the small schooner *Helen E. Russell*, and the loss of four lives at 4 a. m. of the 23d, 8 miles northwest of Juraco; the following is extracted from local newspapers:

> Evening of 28th 13 houses blown down and tobacco seed plants and banana plants destroyed; night of 28th considerable damage done by inundation of a portion of Camajuani and the blowing down of several houses at Sancti Spiritus; damage and loss of one life at Santiago, and damage by the overflowing of the Canti River.

All necessary action was taken to acquaint commercial and shipping and other interests of the development, character, and course of this storm.—*W. B. Stockman, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

During the month six highs and ten lows have been sufficiently well defined to be traced on Charts I and II. The accompanying table shows some of the facts regarding the date and place of origin and last appearance, with the velocity of their movements, and the following description is added:

Highs.—No. I was first seen off the middle Pacific coast. Its trajectory was a little south of east, and after five days it disappeared in north Texas. No. II was first noted to the north of Minnesota. The remaining four were first noted in the middle or northern Plateau regions. All of these five had a path in a general easterly direction and disappeared off the north Atlantic or Nova Scotia coasts.

Lows.—No. VIII was first noted off the north Pacific coast; Nos. I, IV, and VII to the north of Montana; Nos. V and VI in the south Plateau; No. X in Texas, and Nos. II, III, and IX in the eastern Gulf. The beginning of these last three was especially interesting, as there was a more or less disturbed condition in the eastern Gulf of Mexico for several days before the storms gathered enough intensity to move to the north and east. The general paths of the storms was toward the east and north. No. VI was last seen in Manitoba; Nos. I and VIII in Nebraska; No. III off Cape Cod, and Nos. II, V, IX, and X in or near the Gulf of St. Lawrence.—*H. A. Hazen, Professor.*

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a.m.	43	127	5, p.m.	37	102	1,650	4.5	367	15.3
II	6, a.m.	51	91	9, p.m.	47	61	1,580	3.5	437	18.2
III	12, p.m.	52	117	17, a.m.	43	64	3,380	4.5	740	30.8
IV	17, p.m.	47	109	24, a.m.	42	69	3,540	6.5	545	22.7
V	24, p.m.	43	118	28, p.m.	47	61	2,820	4.0	705	29.4
VI	26, p.m.	41	114	*1, a.m.	47	57	3,090	5.5	562	23.4
Total							15,960	28.5	3,356	139.8
Mean of 6 paths							2,660		559	23.3
Mean of 28.5 days									560	23.3
Low areas.										
I	†29, p m.	54	119	2, a.m.	41	100	1,350	2.5	540	22.5
II	3, a.m.	22	83	7, a.m.	46	59	2,280	4.0	570	23.8
III	7, a.m.	29	84	9, p m.	40	69	1,500	2.5	600	25.0
IV	7, p.m.	55	116	10, a.m.	49	92	1,200	2.5	480	20.0
V	11, a.m.	40	108	14, p.m.	51	62	2,790	3.5	797	33.2
VI	14, a.m.	34	111	16, p.m.	53	95	1,620	2.5	648	27.0
VII	16, p.m	49	110	18, p.m.	48	84	1,290	2.0	645	26.9
VIII	18, p.m.	46	128	24, a.m.	42	98	2,490	5.5	453	18.9
IX	26, a.m.	19	79	*2, a.m.	48	56	3,150	7.0	450	18.7
X	26, p.m.	30	100	30, a.m.	48	52	3,120	3.5	891	37.1
Total							20,790	35.5	6,074	253.1
Mean of 10 paths							2,079		607	25.3
Mean of 35.5 days									586	24.4

*November. †September.

RIVERS AND FLOODS.

In the Mississippi River during the month of October, 1899, the stages of water were above the average, and higher than during the corresponding season of 1898, while the Missouri and that portion of the Mississippi south of Alton, Ill., were considerably lower than in 1898. The higher stages above were due to heavy rains at the headwaters of the Mississippi, supplemented by lighter falls southward through Iowa. At St. Paul a stage of 8.8 feet was reached on the 24th, the highest for the season since 1881, when a stage of 13 feet was attained on October 9th.

A marked rise also occurred in the rivers of the South Atlantic States in the early part of the month on account of the heavy rains which resulted from the storm which moved up the South Atlantic coast from the 5th to the 7th. The crests were reached about the 9th. At Fayetteville, N. C., the Cape Fear River rose 15 feet in three days, and at Camden, S. C., the Wateree River rose 13 feet in four days.

Over the remaining rivers low stages continued with practically no interruption. In the Mississippi system below the mouth of the Missouri the waters were lowest during the closing days of the month, while over the eastern rivers the times of lowest stages were variable.

The highest and lowest water, mean stage, and monthly range at 121 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

Heights of rivers referred to zeros of gages, October, 1899.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,954	14	8.8	24	4.0	9-11	5.9	4.8
Reads Landing, Minn	1,884	12	6.3	29, 30	1.4	12, 15	3.1	4.9
La Crosse, Wis	1,819	12						
North McGregor, Iowa	1,759	18	6.1	31	2.0	18-20	3.0	4.1
Dubuque, Iowa	1,699	15	5.4	31	2.1	19	2.9	3.3
Leclaire, Iowa	1,609	10	2.9	31	1.2	20-23	1.6	1.7
Davenport, Iowa	1,593	15	3.8	31	1.9	21, 22	2.4	1.9
Muscatine, Iowa	1,562	16	4.6	31	2.4	23	3.0	2.2
Galland, Iowa	1,472	8	1.6	31	0.9	19-26	1.1	0.7
Keokuk, Iowa	1,463	15	2.4	31	0.7	23-26	1.2	1.7
Hannibal, Mo	1,402	13	3.2	1, 2	1.9	25-27	2.3	1.3
Grafton, Ill	1,306	23	4.1	1	2.7	25-27	3.2	1.4
St. Louis, Mo	1,264	30	4.8	1	2.9	26	3.7	1.9
Chester, Ill	1,189	30	3.1	1	1.7	26	2.3	1.4
Memphis, Tenn	843	33	2.2	1	0.5	31	1.1	1.7
Helena, Ark	767	42	4.4	1	1.8	30, 31	2.7	2.6
Arkansas City, Ark	635	42	3.9	1	1.1	21-24, 31	2.0	2.8
Greenville, Miss	595	42	3.5	1, 2	1.4	30-31	2.2	2.1
Vicksburg, Miss	474	45	2.2	1	— 1.0	25-27, 31	0.2	3.2
New Orleans, La	108	16	4.6	4	2.9	18-20	3.5	1.7
Missouri River.								
Bismarck, N. Dak	1,309	14	2.2	3	1.5	14, 15	1.8	0.7
Pierre, S. Dak	1,114	14	2.7	1	2.4	13-17, 20-28	2.5	0.3
Sioux City, Iowa	784	19	5.1	18	4.7	9	4.9	0.4
Omaha, Nebr	669	18	6.6	1-6	6.4	12-15, 22-28	6.5	0.2
Plattsmouth, Nebr	641							
St. Joseph, Mo	481	10	1.4	28	0.7	13-15, 24, 25	0.9	0.7
Kansas City, Mo	388	21	6.0	28, 29	5.3	15-17	5.5	0.7
Boonville, Mo	199	20	5.7	1, 2	4.9	21-28	5.1	0.8
Hermann, Mo	103	24	5.2	1, 2	4.5	20-22	4.8	0.7
Illinois River.								
Peoria, Ill	135	14	4.6	28	4.0	1-11	4.2	0.6
Youghiogheny River.								
Confluence, Pa	59	10	1.0	1	0.1	28, 29	0.5	0.9
West Newton, Pa	15	23	0.4	1	0.0	20-31	0.1	0.4
Allegheny River.								
Warren, Pa	177	14	1.0	3	0.0	27-31	0.3	1.0
Oil City, Pa	128	13	1.4	2	0.1	27-29	0.5	1.3
Parker, Pa	73	20	1.1	4, 5	0.1	24-29	0.5	1.0
Monongahela River.								
Weston, W. Va	161	18	— 1.0	1, 2	— 2.0	22-25	—1.7	1.0
Fairmont, W. Va	119	25	0.6	1	0.1	26-29	0.3	0.5
Greensboro, Pa	81	18	6.8	1	6.0	22-31	6.3	0.8
Lock No. 4, Pa	40	28	8.5	1-3	5.9	31	7.4	2.6
Conemaugh River.								
Johnstown, Pa	64	7	1.2	1-3, 11, 12	0.5	27-30	0.9	0.7
Red Bank Creek.								
Brookville, Pa	35	8	0.4	29-31	0.2	1-28	0.2	0.2
Beaver River.								
Ellwood Junction, Pa	10	14	— 0.2	1, 2	— 0.5	7, 16, 17	—0.4	0.3
Great Kanawha River.								
Charleston, W. Va	61	30	6.8	1, 2, 12	6.4	25, 26	6.6	0.4
New River.								
Hinton, W. Va	95	14	1.5	12	1.0	23-29	1.1	0.5
Cheat River.								
Rowlesburg, W. Va	36	14	1.0	1	— 1.2	26-31	—0.3	2.2
Ohio River.								
Pittsburg, Pa	966	22	6.2	1	5.2	6, 10, 14	5.6	1.0
Davis Island Dam, Pa	960	25	2.9	1, 4-6	1.5	29	2.2	1.4
Wheeling, W. Va	875	36	2.8	6	1.1	22-31	1.7	1.7
Parkersburg, W. Va	785	36	3.0	9	1.5	26-28	2.2	1.5
Point Pleasant, W. Va	703	39	2.0	10-13	1.1	27-31	1.5	0.9
Catlettsburg, Ky	651	50	1.7	10	0.8	29-31	1.2	0.9
Portsmouth, Ohio	612	50	3.2	14, 15	2.2	29-31	2.7	1.0
Cincinnati, Ohio	499	50	4.4	17	3.5	25-30	3.9	0.9
Louisville, Ky	367	28	5.0	1	4.2	28	4.6	0.8
Evansville, Ind	184	35	2.6	1-3	1.6	31	2.0	1.0
Paducah, Ky	47	40	1.1	1	0.5	13, 16	0.8	0.6
Cairo, Ill	1,073	45	4.7	1	3.0	15, 16, 27	3.5	1.7
Muskingum River.								
Zanesville, Ohio	70	20	6.1	31	5.6	28	5.8	0.5
Miami River.								
Dayton, Ohio	69	18	1.1	29	0.5	1, 22	0.7	0.6
Wabash River.								
Mount Carmel, Ill	50	15	1.0	23, 24, 28-30	0.3	1-18	0.6	0.7
Licking River.								
Falmouth, Ky	30	25	1.6	29, 31	0.3	11-19	0.5	1.3
Clinch River.								
Speers Ferry, Va	156	20	—0.2	9, 30, 31	— 0.8	26, 27	—0.6	0.6
Clinton, Tenn	46	25	3.4	1	1.8	24-28	2.2	1.6
Tennessee River.								
Knoxville, Tenn	614	28	0.2	11	— 1.2	27-29	—0.7	1.4
Kingston, Tenn	534	25	1.2	11, 12	0.5	3, 4	0.8	0.7
Chattanooga, Tenn	430	33	1.9	12	0.8	6, 7, 27, 28	1.1	1.1
Bridgeport, Ala	390	24	0.6	13	0.1	5-7, 18, 19, 28-31	0.2	0.5
Florence, Ala	220	16	0.4	16-18	— 0.1	10, 30, 31	0.1	0.5
Riverton, Ala	190	25	—1.0	16-18	— 1.9	9, 10, 30, 31	—1.6	0.9
Johnsonville, Tenn	94	21	0.7	18-20	0.0	11-13	0.3	0.7